

Adaptation of Superfund Remediation to Climate Change

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EXECUTIVE SUMMARY

The Superfund program undertook an effort to determine the status of climate change adaptation efforts geared to ensure the continuing protectiveness of remedies. The goal was to determine general levels of remedy vulnerability to climate change scenarios, conduct desk audits of remedies identified as highly vulnerable, and make recommendations for improving project and program management to ensure climate change vulnerabilities are evaluated and addressed. The results of the analysis are summarized below:

- The vulnerability screening protocol developed through this effort identified remedy types that could be particularly vulnerable because a physical plant remains at the site or because hazardous substances are being contained at the site and combined this information with site location, specifically assessing those sites located within the 1.5 meter sea level rise (mSLR) zone and within the 100- and 500-year floodplains. Using these criteria, the group identified the universe of Superfund sites with groundwater pump and treat (GW P&T) and on-site containment remedies that lie within floodplain and mSLR zones. Five potentially vulnerable sites were then selected for a desktop audit to determine if and how adaptations to climate change were being addressed. The desktop audit of the vulnerable remedies found that climate change vulnerabilities were generally factored into remedy design and or operations although these vulnerabilities were not necessarily attributed to climate change.
- The analysis also indicated that many of the possible climate change scenarios and associated remedy vulnerabilities are already addressed as part of normal engineering practices.
- Furthermore the analysis found that current remedy selection, construction, and management protocols allow for consideration of climate change scenarios. There is no need for new program components.
- Certain minor recommendations are provided specific to Superfund, such as building basic climate change scenario screening questions into the technical analyses performed in remedial investigation/feasibility study; remedy selection; remedial design/remedial action, and five-year review stages of the overall Superfund process.
- Additional analysis on climate change scenarios for sediments sites is warranted. These were not considered in this analysis but further consideration suggests *in situ* capping remedies may be vulnerable to flood regime changes, and re-suspension and deposition of contaminated sediments on upland areas could result in extensive contamination.

1.0 INTRODUCTION

OSRTI prepared this report with assistance from Tetra Tech under Work Assignment 1-14, Task 5, of Contract No. EP-W-07-078 to begin an evaluation of the vulnerability of remedial actions at Superfund sites to the potential impacts from climate change. This effort follows from the U.S. Environmental Protection Agency's general assessment of how climate change may impact the mission of various EPA programs, and is the Superfund program's initial effort to more specifically evaluate the effects of climate change on accomplishing its mission - protecting human health and the environment from the release or potential release of hazardous substances to the environment. The overall goal of this effort is to identify a small set of candidate sites to use as case studies for assessing how project managers are currently evaluating and responding to the effects of climate change on Superfund remedial actions, and to evaluate if programmatic changes are necessary to ensure climate change impacts are considered. The preliminary analysis identified which Superfund sites were most vulnerable to flooding and sea-level rise. From the preliminary list, the EPA identified sites it considered to be most vulnerable and for which additional information was collected.

This report summarizes the findings of the vulnerability analysis protocol and includes background and approach for identifying vulnerable sites (Section 2.0 Background and Approach); summary of the analysis of five case study sites (Section 3.0 Further Analysis of Vulnerable Sites); recommended process for evaluating the potential effects of climate change (Section 4.0 Recommended Process for Evaluating the Potential Effects of Climate Change); and conclusions (Section 5.0 Conclusion). Appendix A to this report contains site summaries for five of the vulnerable sites.

2.0 BACKGROUND AND APPROACH

The first step in the overall process of determining Superfund vulnerabilities to climate change was to determine what potential climate change effects to evaluate. Table 1 presents a matrix which assesses the severity of a particular climate change effect on various types of remedies for both source material and groundwater. The climate change effects were identified based on the input of climate change experts and discussions among the OSRTI team members. The remedy types are based on the most common remedy types selected in Superfund decision documents from fiscal years (FY) 2005 through 2008, as reported in the EPA's *Superfund Remedy Report*, 13th Edition, September 2010. The group decided to evaluate flooding and inundation as the primary effects because they would have the most predictable short-term (flooding event) and long-term (inundation) impacts and because it is easy to depict the site

TABLE 1
REMEDY SENSITIVITY TO CLIMATE CHANGE

Common Remedy Types	Flooding (Event)	Inundation (Chronic)	Extreme Storms	Large Snowfall	Wild Fires	Drought	Extreme Heat	Landslide (Precip)
Source In Situ								
SVE								
Solidification/Stabilization*								
In Situ Thermal Treatment								
Multi-phase Extraction								
Bioremediation								
Source Ex Situ								
Solidification/Stabilization*								
Physical Separation								
Recycling								
Surface Water Treatment								
Unspecified Off Site Treatment								
On-site Containment								
Groundwater In Situ								
Bioremediation								
Chemical Treatment								
Air Sparging								
Permeable Reactive Barrier								
Groundwater Ex Situ								
P&T								
Vertical Engineered Barrier								
Monitored Natural Attenuation								

- ☐ No known potential impacts
☐ Minor impacts: Potential for temporary loss of remedy functionality or effectiveness, contaminant(s) remain contained
☐ Moderate impacts: Potential for total loss of remedy functionality and effectiveness indefinitely, contaminant(s) remain contained
☐ Major impacts: Potential for total loss of remedy functionality and effectiveness indefinitely, contaminant(s) release

Explanation of Remedy Sensitivity

Flooding (Event): Refers to the flooding of surface water bodies due to storm events.

Inundation (Chronic): Refers to the effects of sea level rise and the chronic or permanent flooding that may occur.

Extreme Storms: Refers to high winds, tornadoes, and hurricanes.

Large Snowfall: Refers to extraordinary snow events which would result in widespread power outages.

Wild Fires: Refers to wild fires that can move quickly.

Drought: Refers to long periods of little or no precipitation.

Extreme Heat: Refers to short periods (for example, a single day) of very high temperatures.

Landslide (Precip): Refers to landslides caused by excessive precipitation and is assumed to involve the site itself.

location with regard to predicted flooding and mSLR zones. GW P&T and on-site containment were selected by the group as the remedy types on which to focus because they involve actions where hazardous substances remain on the site (as represented by on-site disposal, on-site containment, and landfills) or a physical treatment plant exists on the site and will likely remain active for a long period of time.

The EPA identified all sites with selected remedial actions involving on-site containment and groundwater pump and treat (GW P&T) to determine which of those sites might be susceptible to flooding and sea-level rise. These remedies also lend themselves to being identified using the EPA's Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS) which uses key words to describe remedial actions that have been selected at Superfund sites. The site identification was not meant to be complete but rather to identify a large number of sites that may be vulnerable to climate change impacts.

A query of the CERCLIS identified Superfund sites that (1) are final on or deleted from the National Priorities List (NPL) with the targeted remedial actions and (2) the physical locations of the sites using the single latitude and longitude coordinates available in CERCLIS. These sites were then mapped using the coordinates and a list of sites was developed with on-site containment (as represented by on-site containment, on-site disposal, and landfills) and GW P&T remedies that meet the following criteria:

- Lie within a 100-year floodplain of a surface water body
- Lie within a 500-year floodplain of a surface water body
- Lie within the sea-level rise zone up to 1 meter above high tide
- Lie within the sea-level rise zone from 1 to 1.5 meters above high tide

The EPA used the Federal Emergency Management Agency (FEMA) floodplain maps to identify floodplains and United States Geological Survey (USGS) elevation data maps to identify sea-level rise zones. The 1 meter and 1 to 1.5 meter sea-level rise zones were selected based on input from the EPA. A buffer zone of 250 yards was added for the floodplain zones and conservative assumptions about where floodplains may extend in those areas where floodplains have not yet been mapped were made. Several uncertainties exist with this approach, the greatest of which is the use of the single point coordinates to identify the location of the potentially vulnerable sites. The use of a single point creates the possibility of missing site locations that may actually be vulnerable.

This effort did not evaluate sediment sites as a site type vulnerable to the impacts of climate change unless the sediment site also involved on-site containment or GW P&T. The recent flooding associated

with Hurricane Irene has shown that sediment sites are vulnerable to the impacts of climate change; however, these impacts apply to all sediment sites located on surface water bodies subject to flooding and the scouring and sediment movement associated with that flooding. All such sediment sites should be considered to be vulnerable to the effects of climate change. This effort sought to identify other types of remedial actions that may also be vulnerable.

The initial analysis identified the various categories for all sites either final on or deleted from the National Priorities List. The initial analysis identified the number of sites falling into the various remedy type and location categories. The EPA used this information to determine which sites to focus on for additional data collection. The initial analysis identified the number of NPL sites that are outside the floodplain zones, outside the sea-level rise zones, or either have remedial actions that have a low susceptibility to the effects of climate change or that have not yet selected a remedy. Of the 1,639 sites final on or deleted from the NPL at the time of this analysis, 698 are outside the two floodplain zones and 420 have either a low susceptibility remedy with regard to flooding or have not selected a remedy, which means there are about 521 sites that may be vulnerable to flooding. Of these same 1,639 sites, 1,170 sites are outside the sea-level rise zones and the same 420 sites identified in the floodplain analysis have either a low susceptibility remedy to inundation from rising sea levels or have not selected a remedy, which means there are about 49 sites that may be vulnerable to rising sea levels. Table 2 shows the number of sites that are potentially vulnerable after combining information on remedy type, site location, floodplain zones, and sea-level rise zones. A total of 24 sites were identified for further analysis.

TABLE 2
REMEDY TYPES AND ZONES OF SUSCEPTIBILITY

Remedy Types	Combined Zones of Susceptibility				
	100-year FLP and 1 m SLR	100-year FLP and 1 – 1.5 m SLR	500- year FLP and 1 m SLR	500-year FLP and 1 – 1.5 m SLR	Total
On-Site Disposal Only	0	0	2	0	2
On-Site Containment Only	4	0	3	1	8
GW P&T	0	1	0	0	1
On-Site Disposal and GW P&T	0	1	0	0	1
Landfill and On-Site Containment	3	0	0	0	3
GW P&T and On-Site Containment	4	0	2	0	6
On-Site Disposal, GW P&T, and On-Site Containment	1	0	2	0	3
TOTAL	12	2	9	1	24

GW P&T = Groundwater pump and treat

FLP = Floodplain zone

SLR = Sea-level rise zone

m = meter

Publicly available information from the Superfund Information System was used to collect site-specific information about the 24 sites and to develop site-specific maps using more accurate polygon coordinates to locate the vulnerable components of the sites in relation to the floodplain and sea-level rise zones. Using the more accurate mapping coordinates obtained from the site-specific information sources, some of the 24 sites were determined to lie outside one or more of the floodplain and sea-level rise zones. Appendix A presents a table summarizing information on the 24 sites. Because the analysis involved combining floodplain and sea-level rise information, the 24 sites are located in coastal areas. Sites located in the inland areas of the United States were not included because they do not fall into a sea-level rise zone.

3.0 FURTHER ANALYSIS OF VULNERABLE SITES

A total of five sites were identified as meriting further analysis to “ground truth” the site vulnerability screening process outlined so far in this report. The five sites were selected based on (1) the nature of the on-site containment and GW P&T remedies present at the sites, (2) the types and amounts of contamination that remain at the sites, and (3) the geographic location of the sites so that multiple regions were represented.

The Remedial Project Managers for each of the five sites were contacted to update the publicly available information. Table 3 summarizes the information collected for the 5 sites. Appendix A presents summaries using the Superfund Information System data for the five sites selected for further analysis. Of the five sites analyzed, two appeared to meet vulnerability “conditions”, in that they had on-site containment or GW P&T remedies and they are located in areas vulnerable to flooding and inundation. In both cases, these vulnerabilities were known by the RPMs and had been considered in several ways. Flooding and inundation threats at these sites are addressed through the design process and by operation and maintenance procedures put in place to mitigate the threats and maintain the integrity of the remedies. It should be noted that CERCLIS data searches yield data of unreliable value for screening site vulnerabilities. Site documentation and discussions with the RPM are much more reliable but also more resource intensive.

TABLE 3
SUMMARY OF SELECTED FOCUS SUPERFUND SITES

Site	Scientific Chemical Processing, Bergen County, NJ	Atlantic Wood Industries, Inc., Portsmouth County, VA	Airco Plating Co., Dade County, FL	Pepper Steel & Alloys, Inc., Dade County, FL	Wyckoff Co./Eagle Harbor, Kitsap County, WA
EPA Region	2	3	4	4	10
COCs	SVOCs, VOCs, PCBs, PAHs, Pesticides	Metals, VOCs, PAHs, Creosote, Dioxin, Pentachlorophenol.	Metals, SVOCs, VOCs.	PCBs, Metals	PAHs, SVOCs, VOCs, Metals, Pesticides
ROD issuance	OU1 -1990 OU2 – 2002 OU3 – not issued	OU1 – 1997 & RODA in 2007 OU2 – 2007 OU3 - 2007	1993	1986	OU1 – 1994 OU2 – 2000 OU3 – 1992 OU4 – 1994 (int) and final in 2000
Last FYR	1/08	NA	9/06; 9/2011	9/07	9/07
Next FYR	1/13	2017 – based on RA start in 2012	2016	9/12	9/12
Remedy	OU1 - Containment via soil-bentonite slurry wall, sheet pile wall, a landfill cap, and groundwater collection system. (no P&T system & no longer under consideration) OU2 remedy made OU1 remedy final and includes replacement of sheet pile wall between creek and on-site slurry wall, new cap, hot spot removal and updating the groundwater collection.	Dredging and on-site sediment consolidation; monitored natural recovery of sediments; monitored natural attenuation of ground water; soil cover; DNAPL containment; GW hydraulic controls	Consolidation of contaminated material under RCRA-type cap with GW P&T.	Containment of stabilized soils in a soil/cement monolith placed above mean sea level (~2' - ~12.5' amsl). Has a 1.5' crushed lime rock cover. GW monitoring to measure solidification performance. (Post-remedy reuse has included asphalt, cement and other approved forms of capping plus added cover material)	OU1: Sediment cap OU2: Removal OU3: Soil and sediment cap in an upland area OU4: GW P&T
Floodplain Zone	100 year	100 year	100 year	100 year	100 year
Sea Level Zone	Entire site <1 m SLR	Eastern portion of site 1-1.5 m SLR	Not affected by SLR	Entire site higher than 1-1.5 m SLR (<i>per RPM, 1-12-12</i>)	Portions of site in both <1 m and 1-1.5 m SLR areas
Location Description	Site located in coastal wetland & bordered by tidal Peach Island Creek	Contaminated soil, ground water and sediment in and along Southern Branch of Elizabeth River	Located near Miami Airport and is 4.5 miles inland from Atlantic Ocean and 7' above sea level. Small river located 3,200' southwest of site.	Site is ~ 7 feet amsl. Area filled in 1960s to elevate for commercial use and is adjacent to Miami Canal (major drainage canal subject to human manipulation for flood control)	Site is adjacent to Eagle Harbor and Puget Sound. Groundwater P&T equipment is located on fill material about 8-10' amsl.
RPM	Stephanie Vaughn Vaugh.stephannie@epa.gov 212-637-3914	Randy Sturgeon 215-814-3227 sturgeon.randy@epa.gov	Peter Thorpe Thorpe.peter@epa.gov 404-562-9688	Jan Rogers Rogers.jan@epa.gov 561-616-8868	Howard Orlean orlean.howard@epa.gov 206-553-2851

Site	Scientific Chemical Processing, Bergen County, NJ	Atlantic Wood Industries, Inc., Portsmouth County, VA	Airco Plating Co., Dade County, FL	Pepper Steel & Alloys, Inc., Dade County, FL	Wyckoff Co./Eagle Harbor, Kitsap County, WA
<i>Responses to Climate Adaptation Questions</i>					
Flooding or other impacts due to climate change considered in ROD? Explain.	Potential for flooding was considered in ROD and design includes features to protect remedy from flooding (see above). Climate change linked flooding not specifically considered.	Yes, in the remedial design. Elevation of bulkhead containment wall set in range being used by Virginia Port Authority to protect against rising sea level due to climate change	ROD issued in 1993; no discussion of flooding or sea level rise.	Probably not. Remedy decision is actually a PRP-lead Enforcement Decision Document issued in 1986. Stormwater drainage off the monolith was addressed in the remedial design.	No. ROD completed prior to 2000 and awareness of climate change becoming an issue.
Flooding or other impacts considered in 5YR? Explain.	No, flooding was not particularly considered as part of 5YR but remedy designed to protect against flooding.	NA – no 5YR yet	No, flooding and sea level rise were not considered during the FYR because the Atlantic Ocean is 4.5 miles away and small river is 3,200' from site.	No. Flooding from ocean rise is not viewed as a viable threat to remedy because site is 7 feet amsl and area-wide infrastructure is likely to be protected. Area has infrastructure & water management programs in place to address flooding from storms/hurricanes.	No. Previous 5Yrs did not consider flooding or other effects that could be related to climate change
Is site or other monitoring data available to evaluate risks?	Yes. Under O&M Plan, site inspected quarterly. Part of inspection is to look for erosion due to storm runoff or flooding. Additional inspection required after 5 year storm event. Maintenance as needed conducted following inspections.	Yes. Area is known to be vulnerable to sea level rise and VA and others collecting data that could be used. Site-specific data water level data is not collected.	No data is being collected from the surface water bodies as part of the cleanup. Groundwater levels monitored annually.	South Florida Water Management District (SFWMD) manages area drainage and water use and maintains extensive monitoring network. Site groundwater monitoring network measures solidification performance.	Bathymetric data is collected for Eagle Harbor about every 5 yrs. City of Bainbridge Island has gotten grants to collect coastal geomorphic data for site. WA Dept. of Ecology and NOAA may have relevant data.
Is there a site contingency plan for flooding?	There is not a specific contingency plan beyond the provisions in the O&M plan but this plan does require a site inspection and maintenance following 5 year storm events.	Flooding would not occur due to sea level rise. However, sea level rise will decrease magnitude of hurricane storm surge required to inundate area. This type of flooding should not impact remedy.	No, given site's location the O&M plan does not consider flooding.	No. Site is located 7' above amsl so is not expected to flood. There is area wide contingency planning by the SFWMD.	Yes. In O&M plan there are provisions for orderly shutdown of groundwater treatment plant for storm impacts and loss of power. Also plant is monitored remotely.
Is site vulnerable to climate change?	Site may be vulnerable given proximity tidally influenced creek	No	No	No	Site may be vulnerable during extreme rain storms; flooding from Puget Sound is low risk.
Date information reviewed by the RPM	1/18/2012	1/17/2012	1/13/2012	1/12/2012	1/12/2012

4.0 RECOMMENDED PROCESS FOR EVALUATING THE POTENTIAL EFFECTS OF CLIMATE CHANGE

The EPA recommends the following process for evaluating the effects of climate change on the remedial program:

1. Screening sites for climate change vulnerability: Sites should be screened to identify the sites that are most vulnerable and to evaluate current efforts to address vulnerabilities. The screening of sites conducted for this effort is one approach to this process.
2. Implementation of climate change considerations: The Superfund program is taking steps to ensure climate change vulnerabilities are addressed. Current processes could be easily amended to ensure that the investigation and remediation approaches consider adaptation to climate change impacts, including modifying screening tools, contract language, and technical guidance to identify climate change impacts.
3. Other Cleanup Programs: The approach that is applied to the Superfund program has applicability to other cleanup programs, such as Brownfields and Resource Conservation and Recovery Act (RCRA) corrective action, however a cross-program analysis is not recommended. The climate change impacts themselves are program neutral.
4. Use of existing processes: The Superfund program has an existing five year review process for periodically evaluating remedial actions that do not allow for unrestricted exposure or unlimited use of the site after completion of the remedial actions. Five year reviews are conducted as required by the CERCLA statute and as a matter of EPA policy. In addition, for remedial actions that have an operation and maintenance (O&M) component, the preparation and implementation of required O&M plans also offers an opportunity for preparing for and addressing potential effects of climate change. The EPA can use these existing processes to explore options for including analysis and response to potential effects of climate change and to document the extent to which this type of analysis is already conducted. The EPA can test the efficacy of these two existing processes on the case studies it selects from the 24 most vulnerable sites, and make adjustments to its guidance documents to ensure climate change vulnerabilities are evaluated when necessary.

In addition, the EPA recommends evaluating the effects of climate change for all sediment sites that are vulnerable to the movement of contaminated sediment caused by the scouring that occurs during flooding, based on the recent impacts associated with Hurricane Irene. The effects of climate change on sediment

sites should be evaluated whether or not the sediment site is in the investigation or remedy phase of the Superfund process.

5.0 CONCLUSION

The EPA identified and evaluated 24 sites that were considered to be the most vulnerable to the effects of both flooding and sea-level rise associated with climate change. The EPA further evaluated five sites to assess the actual vulnerabilities they may face and to evaluate how these sites were currently addressing climate change impacts. Two of the five sites have identified vulnerabilities to climate change impacts and are using the current Superfund processes to address these impacts.

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Sea-Level Rise Zones

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APPENDIX A

SITE SUMMARIES, FOR THE FIVE SITES SELECTED FOR DESK AUDIT AND SUMMARY TABLE OF 24 MOST VULNERABLE SITES

A. AIRCO PLATING SITE, DADE COUNTY, FLORIDA, EPA REGION 4 (MOVE THIS DETAILED INFORMATION TO THE APPENDIX)

Airco Plating Co. (APC) is located at 3650 N.W. 46th Street, Miami, Florida. The Site occupies approximately two acres in a predominately industrial and commercial area of northeast Dade County. The Miami Canal is located approximately 2/3 of a mile southwest of the Site and is the only surface water body in the vicinity of the Site (Five Year Review (FYR), 2006, p. 3). The Facility primarily plates steel, copper, and brass with zinc. It also plates various items with brass, cadmium, chromium, copper, nickel, and tin. The technical components of the remedy that are potentially vulnerable to the effects of climate change include a RCRA-type cap over cadmium and PCE-contaminated soil, extraction of groundwater with subsequent on-site air stripping and discharge to a publically owned treatment works (POTW) or the surficial aquifer via a recharge gallery. The Airco Plating site is located within the 100- and 500-year floodplains and is extremely close to the 1 – 1.5 meter sea-level rise zone.

B. ATLANTIC WOOD INDUSTRIES, INC., PORTSMOUTH COUNTY, VIRGINIA, EPA REGION 3

The Site is generally located south of Elm Avenue adjacent to the Southern Branch of the Elizabeth River in Portsmouth, Virginia. The Site includes approximately 48 acres of land with contaminated soil on the industrialized waterfront area of Portsmouth. The site includes contaminated sediments in areas of the Elizabeth River generally extending from the Atlantic Wood Industries (AWI) facility east to the navigation channel, north to the eastern-most part of the Portsmouth port and Industrial Commission property and south into sediments adjacent to the South Annex of the Norfolk Naval Shipyard. From 1926 to 1992, a wood-treating facility operated at the site using both creosote and pentachlorophenol (PCP). The technical components of the remedy that are potentially vulnerable to the effects of climate change include a soil cover with dense non-aqueous phase liquids (DNAPL) containment, containment with sheet pile walls, dredging with an underwater clay cap, stabilization and solidification, and wetlands mitigation. The site is located within the 100- and 500-year floodplains and the eastern portion of the site is located in the 1 – 1.5 meter sea-level rise zone.

C. PEPPER STEEL & ALLOYS, INC., DADE COUNTY, FLORIDA, EPA REGION 4

The Site, located in Medley, Dade County, Florida, consists of a 25-acre area located near the eastern border of Medley and just across NW South River Drive from the Miami Canal (FYR, 2007, p. 4). The site was used by several industrial businesses from the mid-1960s to the mid-1980s. The businesses included the manufacture of batteries, pre-cast concrete products, and fiberglass boats, as well as a truck

and heavy equipment repair business, a sandblasting and painting service, and an automobile scrap operation. After operations ceased in the mid-1980s and until the advent of reuse in 2005, the Site was vacant and subject to extensive dumping of trash, vehicles, and construction debris. The technical components of the remedy that are potentially vulnerable to the effects of climate change include excavation of soil, soil stabilization/solidification with a cement type mixture and placement on-site and the extraction, oil and water separation, and off-site disposal of oil and groundwater. The site is located in the 100- and 500-year floodplains and in the 1 – 1.5 meter sea-level rise zone.

D. SCIENTIFIC CHEMICAL PROCESSING SITE, BERGEN COUNTY, NEW JERSEY, EPA REGION 2

The Site lies at the corner of Paterson Plank Road and Gotham Parkway in Carlstadt, New Jersey. The land use at the site and vicinity is classified as light industrial by the Borough of Carlstadt (FYR, 2008, p. 2). The land on which the Scientific Chemical Processing (SCP) site is located was purchased in 1941 and used for solvent refining and solvent recovery. Aerial photographs from the 1950s, 1960s, and 1970s indicate that drummed materials were stored on the site. While in operation, SCP received liquid byproduct streams from chemical and industrial manufacturing firms then processed the materials to reclaim marketable products. Liquid hydrocarbons were processed to some extent, and then blended with fuel oil. Other wastes on-site included paint sludges, acids, and other unknown chemical wastes. SCP used the site for processing industrial wastes from 1971 until the company was shut down by court order in 1980. Technical components of the remedy that are potentially vulnerable to the effects of climate change include a containment wall comprised of a soil-bentonite slurry to approximately 10 feet bgs, a sheet pile retaining wall along Peach Island Creek, a horizontal infiltration barrier, landfill cap, and a groundwater pump and treat system with off-site discharge and monitoring. The site is located in the 100- and 500-year floodplains and in the 1 meter sea-level rise zone.

E. WYCKOFF CO./EAGLE HARBOR SITE, KITSAP COUNTY, WASHINGTON, EPA REGION 10

The Site is located on the east side of Bainbridge Island in central Puget Sound, Kitsap County, Washington. The Site includes the former Wyckoff Company wood-treatment facility, contaminated subtidal and intertidal sediments in Eagle Harbor, and other upland sources of contamination to the harbor, including a shipyard formerly located in Eagle Harbor (FYR, 2007, p. 9). At the Wyckoff Site, soil and groundwater are contaminated with creosote (along with accompanying PAHs), PCP, and other wood-treating compounds. Marine sediments in Eagle Harbor are contaminated with PAHs and other

organics associated with wood treating, as well as with heavy metals such as mercury, copper, lead, and zinc from the former shipyard (FYR, 2007, p. 9). From the early 1900s through 1988, a succession of companies treated wood at the Wyckoff property for use as railroad ties and trestles, telephone poles, pilings, docks, and piers. The plant was one of the largest in the United States, and its products were sold throughout the nation and rest of the world. The technical components of remedy that are potentially vulnerable to the effects of climate change are (1) a sediment cap, (2) a low-permeability cap and a shoreline protection area, (3) a tidal barrier system, a cap across the former Bainbridge Marine Services upland area, a confined disposal area (CDA) for dredged sediments, and capping of sediments, and (4) a groundwater pump and treat system and an upgradient groundwater cutoff wall along the southern boundary of the former process area. The site is located in the 100-year floodplain and portions of the site are located in the 1 – 1.5 meter sea-level rise zone.

TABLE A-1
ADAPTATION OF SUPERFUND REMEDIATION TO CLIMATE CHANGE – SUMMARY TABLE OF THE 24 SITES

EPA Region	Site Name and Location	COCs	Last FYR Date	Next FYR Date	Remedies in Place	Floodplain Zone	Sea Level Zone
1	New Bedford Harbor, Bristol County, MA	Metals and PCBs.	9/10	9/15	Site includes contaminated sediment in several containment facilities. All other sediment disposed off-site. No GW P&T.	100-Year.	Most of site <1 m. Portions in 1-1.5 m.
2	Hercules, Inc. (Gibbstown Plant), Gloucester County, NJ	Metals, PAHs, VOCs, SVOCs, Phenols.	N/A (remedy not complete)	5 years after remedy complete.	Consolidation of contaminated material under 24" cap. No GW P&T.	100-Year.	Most of site <1 m. Portions in 1-1.5 m.
2	Martin Aaron, Inc., Camden County, NJ	Metals, SVOCs, PCBs, Pesticides, VOCs	N/A (remedy not complete)	Five years after remedy complete.	Capping residual soil with GW P&T.	100-Year.	Not affected by SLR.
2	Scientific Chemical Processing, Bergen County, NJ	SVOCs, VOCs, PCBs, PAHs, Pesticides	1/08	1/13	Containment wall of a soil-bentonite slurry, a landfill cap, and GW P&T.	100-Year.	Entire site <1 m SLR.
2	Syncon Resins, Hudson County, NJ	VOCs, SVOCs, PCBs, Metals, Pesticides	8/11	8/16	GW P&T.	100-Year.	Most of site <1 m. Small portion 1-1.5 m.
3	Atlantic Wood Industries, Inc., Portsmouth County, VA	Metals, VOCs, PAHs, Creosote.	N/A (ROD completed 2007)	11/12	Site included a soil cover with DNAPL containment and an underwater clay cap. No GW P&T.	100-Year.	Eastern portion of site 1-1.5 m SLR.
3	Enterprise Avenue, Philadelphia County, PA	VOCs	3/07	3/12	Containment of waste and soil in an on-site landfill with clay liner and GW P&T.	Eastern portion in 500-Year.	Not affected by SLR.
3	Publicker Industries, Inc., Philadelphia County, PA	PAHs, PCBs, Metals	1/10	1/15	GW P&T completed in 1997.	100-Year.	Not affected by SLR.
3	St. Juliens Creek Annex (U.S. Navy), Norfolk County, VA	Metals, SVOCs, VOCs, Pesticides	N/A (remedy not complete)	Five years after remedy complete.	A soil cover is in place over all wastes associated with the site.	Most of site 100-Year. Central portion 500-Year.	Northeast and southeast portions in 1-1.5 m SLR area.
3	Wildcat Landfill, Kent County, DE	SVOCs, Metals	7/07	7/12	Capping of contaminated waste and soil.	100-Year.	Most of site in 1-1.5 m SLR area.
4	Airco Plating Co., Dade County, FL	Metals, SVOCs, VOCs.	9/06	9/08 (not on SIS)	Consolidation of contaminated material under RCRA-type cap with GW P&T.	100-Year.	Not affected by SLR.
4	Anodyne, Inc., Dade County, FL	Metals, VOCs.	N/A (remedy not complete)	Five years after RA start	GW P&T ongoing.	500-Year.	Entire site 1-1.5 m SLR.
4	B&B Chemical Co., Inc., Miami-Dade County, FL	Metals, VOCs	4/07	4/12	Soil cover with asphalt cap to prevent rainwater percolation. GW P&T complete.	100-Year.	Entire site 1-1.5 m SLR.
4	MacAlloy Corporation, Charleston County, SC	Metals, Radioactive Materials	9/10	9/15	Capping of sediment with in-situ treatment of groundwater, and ex-situ treatment of soil.	Most of site 100-Year.	Most of site 1-1.5 m SLR. Northeast portion <1 m SLR.

EPA Region	Site Name and Location	COCs	Last FYR Date	Next FYR Date	Remedies in Place	Floodplain Zone	Sea Level Zone
4	Miami Drum Services, Miami-Dade County, FL	Metals, PAHs, VOCs, SVOCs, Pesticides	5/08	5/13	GW P&T.	500-Year.	Entire site 1-1.5 m SLR.
4	Munisport Landfill, Miami-Dade County, FL	Metals, SVOCs, PAHs, VOCs	N/A (NFA achieved)	N/A (NFA achieved)	GW P&T completed. NFA achieved.	100-Year.	Small area <1m SLR.
4	Pepper Steel & Alloys, Inc., Dade County, FL	Metals	9/07	9/12	Containment of stabilized soil in a cement mixture with GW P&T.	100-Year.	Entire site 1-1.5 m SLR.
4	Raleigh Street Dump, Hillsborough County, FL	Metals, SVOCs, PAHs	N/A (ROD issued in 2009)	Within 5 years of RA start	IC with a contingency for GW P&T.	100-Year.	Most of site 1-1.5 m SLR. Small portion <1 m SLR.
4	Stauffer Chemical Co. (Tarpon Springs), Pinellas County, FL	SVOCs, Metals, Radioactive Materials	N/A (remedy not complete)	Five years after RA start	Caps are in place at the main pond area, slag area, and several other areas with stabilization of contaminated material below water table.	Most of site 100-Year. Northeast part 500-Year.	Most of site not affected by SLR. Southern part in both <1 and 1-1.5 m SLR areas.
6	Bailey Waste Disposal, Orange County, TX	TPH, VOCs, Metals, PAHs	9/10	9/15	Stabilization of contaminated media into containment area and cap. No GW P&T.	100-Year.	Map not available.
10	Commencement Bay, Nearshore/Tide Flats, Pierce County, WA	VOCs, SVOCs, PAHs, Metals, Pesticides, PCBs	12/09	12/14	OU1: Underwater cap of sediment. OU3: Soil stabilization and soil cap. OU19: Sediment dredging and soil cap. OU20: Excavation, containment in cap. OU22: Cap of contaminated soil below 18".	Most of site 100-Year.	Different areas include both <1 and 1-1.5 m SLR areas.
10	Old Navy Dump/Manchester Lab Kitsap County, WA	PCBs, Metals, Pesticides, TPH	9/09	9/14	Excavation of contaminated soil and placement in an underwater cap. No GW P&T.	Small eastern portion in 100-Year.	Not affected by SLR.
10	Tulalip Landfill, County, WA	PCBs, Metals, PAHs	8/08	8/13	A landfill cap is in place with a landfill gas collection system.	Most of site in 500-Year. Small part of 100-Year	Small portion of site in 1-1.5 m SLR area.
10	Wyckoff Co./Eagle Harbor, County, WA	PAHs, SVOCs, VOCs, Metals, Pesticides	9/07	9/12	OU1: Sediment cap. OU2: Soil cap. OU3: Soil and sediment cap in an upland area. OU4: GW P&T.	100-Year.	Portions of site in both <1 m and 1-1.5 m SLR areas.